

REMARKS

Claims 1 and 21 were amended to include the limitation that the process liquid filtration apparatus includes “a pump adapted to provide a process fluid pressure of from approximately 20 to 150 psi for the process liquid to flow through the filter bed”. Support for this amendment is found in the present application, specifically in cancelled claim 9. Additionally claims 1 and 21 were amended to include the limitation of “a bed support adapted to restrain said super-buoyant particles and resist the process fluid pressure required to move said process liquid through the filter bed”. Support for this amendment is found in the specification, specifically paragraph [0050] and [0078]-[0080]. Finally, claims 1 and 21 were amended to include the limitation that the process liquid filtration apparatus includes “a backwashing system effective for removing contaminants from said super-buoyant particles”. Support for this amendment is found throughout the specification, including paragraph [0089]. Applicant submits that no new matter was added by this amendment.

Claims 1-3, 7, 21, 25 and 36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo 5,618,431. Based on arguments previously submitted in response to prior Office Actions, Applicant submits that the present amendments to the claims of the application overcome this rejection. In order to expedite prosecution of this application, Applicant highlights the following reasons for allowance.

A. Present invention uses increased pressure

Specifically, one of the most significant consequences of utilizing small diameter media described in the present application is the increase in pressure required to pump process fluid through the filter bed. The pressure required to pump process fluid through the filter media in

the presently claimed system ranges from approximately 20-150 psi (see claim 9 of the present application), or from 100 to almost 500 times greater than the pressure required to pump water through the filter described in Hsiung (0.31 to 0.45 psi as cited in Column 8, lines 13-14) which calls for the use of media in a size range almost identical to that called out by Kondo (from 1.5 to 20 mm in average diameter – Hsiung, Column 4, line 62). Similarly, the pressure required to pump water through a media bed, as described in Kondo, is only 0.51 psi (Column 9, line 32) for a bed formed of 4 mm (average) diameter particles. Clearly, the pressure requirements dictated by the media specified in both the Hsiung and Kondo patents are substantially lower than the requirements specified in the present application. The need to accommodate this increased pressure dictates a series of unique structural and structural reinforcement features to form a reinforced media retaining plate, which are described in the present application. Since none of the prior art appreciates these increased pressures, it would not be obvious to use the teachings of the prior art to obtain the presently claimed invention.

B. Filter Media Retaining Plate Prevention of Fluid Backflow

One of the requirements that evolve from the need for a reinforced filter media retaining plate with smaller openings to accommodate the use of smaller diameter filter media is that the retaining plate won't allow fluid to enter the filter chamber during fluid draining to allow a vortex to develop for media cleaning, as described in the Kondo patent. Specifically, Kondo (column 3, lines 8-25) states the following:

“In the first, basic, embodiment of the invention, since the water is rapidly discharged from beneath the filter layer to outside the treating tank, the water level above the filter layer drops, and at the same time, the filter layer itself descends in the treating tank, while maintaining its initial gathered state.

Similarly, in the second embodiment, when the water level in the water seal descends to break a seal, which is caused by the air supplied into the air sump, the air in

the air sump instantly passes through the air injection pipe to be discharged through the cleaning water discharge pipe.

As a result, by momentary air flow injection, water in the bottom of the treating tank can be discharged outside the treating tank through the cleaning water discharge pipe, and water in the bottom of the tank flows into the empty air sump, so that a water level above the filter layer suddenly descends. The filter (sic) layer itself simultaneously descends in the treating tank while maintaining its initial gathered state.”

In contrast, the present application, at paragraph [0050] states:

“Using smaller diameter media or thicker media beds carry a power penalty, however, as a more powerful, high pressure pump is required to force the process liquid through such a super-buoyant media bed. To resist the pressure required to move the process liquid through these beds, a strong multi-component “sandwich” is used as a bed restraint 16 (FIG. 2,3).”

In the preferred embodiment of the multi-component “sandwich”, as provided in claims 39 and 40, the design of this multi-component sandwich must not only resist the higher pump pressures required for the use of filter media smaller than 1 mm in diameter, but it must also insure that the component layer that is in contact with the filter media has openings that are smaller than the diameter of the filter media being used. If the openings in this component layer are not smaller than the diameter of the filter media being used, the media will escape through the bed restraint and the filtration process will cease to operate.

As a consequent of the Applicant’s stated requirement for high pump pressure to force fluid through the media and the bed restrain, there is no possibility that the backwash system described in Kondo will function with media having a diameter of less than 1 mm. The Kondo backwash system, as described in the first paragraph of this section, is clearly a gravity-driven process in which the cleaned fluid above the filter media retaining plate is drained back down

into the filter chamber through the retaining plate and the media itself, and this draining effect is crucial to the establishment of the vortex that Kondo specifies is the central mechanism for the cleaning of the media. In the present Application, this gravity-induced rapid drain will not occur (and thus no cleansing vortex will be formed), as the pressure head present in the fluid above the media retaining plate is not high enough to force the fluid to flow back through the retaining plate and the media in a rapid fashion as needed by the Kondo system for proper backwash operation. Thus, the backwash system of the Kondo reference is not designed to handle small diameter particles as claimed by the present invention.

C. Unique backwash system

The backwash process is pictured in FIG. 5 of the present application. FIG. 5 is a diagrammatic view of the backwash process that illustrates the various positional relationships of the filter bed to the backwash spray nozzle during a complete filter and backwash cycle application. As presented in claim 41, the spray nozzle is located below the bed support in a preferred embodiment of the present invention. FIG. 5 shows directly how the filter bed raises and lowers **as a homegenous “plug”** within the filter housing. This behavior is due the adhesion of the filter media particles to one another during both filtration and backwash operations. This behavior is also what prevents the bed from being disrupted by the draining of fluid from the filter chamber, as described by Kondo. The net behavior of the small diameter, super-buoyant media during backwash described in the present application is this:

- 1) as the clean fluid drains from the section above the media retaining plate into the bed, the bed particles are not disturbed because of the high particulate interaction and adhesion that takes place in the bed
- 2) the bed particles will not move downward in the filter housing until the fluid level has dropped below the bottom edge of the filter media mass (unlike the description in Kondo

et. al., where the media mass begins to move downward as the "water level above the filter layer drops, and at the same time, the filter layer itself descends in the treating tank, while maintaining its initial gathered state", Kondo et. al. Column 3, Lines 8-25).

3) even after the bed has moved downward in the filter housing, the media behave as a homogenous mass, immune to the horizontal movements of the fluid at the bottom of the bed (and thus unable to enter into the establishment of the vortex cleaning mechanism described by Kondo et. al.)

Thus, in the same fashion as previously stated, this finding illustrates the non-functionality of the Kondo reference for the use of small diameter super-buoyant media as described in the present application.

In summary, the exact problems involving the use of buoyant filter media of less than 1.0 mm in diameter is specifically described in the present application. The novel filter design and backwash mechanism described in the present application are the only methods described to date that allow the use of such small particle media without experiencing the problems described by the cited patents.

D. The Kondo reference itself specifically teaches that particles less than 1.0 mm may not be used.

The Examiner has asserted that "particles having a size of slightly less than 1.0 mm, as included in the instant filtration apparatus, would appear to result in filtration properties, which would have been considered patentably indistinguishable from the use of particles having a size of 1 mm as disclosed in Kondo". However, the Examiner's prima facie case of obviousness may be rebutted by showing that the reference "teaches away" from the claimed invention in any material respect. As previously stated by the Applicant, the "filtration properties" of the filter

particles are not the only property of the filter particle that affects the operation of a liquid filtration apparatus. In order for the filtration apparatus to operate effectively, “dirty” filter media must be able to pass by the filter particles in order to remove the contaminants. In the case of super-buoyant particles of the size claimed by the present application, clogging of the filter is a significant problem due to the electrostatic attraction of such small particles. This problem is expressed in the prior art in many ways. First, any super-buoyant particles located in the prior art are identified as being larger than 1.0 mm. Second, the Kondo reference *specifically teaches* that particles “smaller than 1 mm” result in the “growth of biological membrane or blocking of flow through the filter medium” (see column 5, lines 63-67). Furthermore, the Kondo reference only provides a specific Example including filter particles having a diameter of 4 mm (see column 9, lines 22-25). Since the claims of the present invention are directed to “a filter bed for removing particulates from a process liquid”, it is clearly material that the process liquid must be capable of moving through the filter bed which contains the super-buoyant particles. Since the Kondo reference clearly teaches that filter particles “smaller than 1 mm” would provide an inoperable filter apparatus, the Kondo reference clearly “teaches away” from the claimed invention.

“A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant”, In re Gurley, 27 F.3d551, 31 USPQ2d 1130 (Fed.Cir. 1994). Since the Kondo reference clearly teaches one of ordinary skill that the flow through the filter medium would be blocked if one used filter particles that were “small than 1 mm”, the Kondo reference discourages one of ordinary skill from following a path directed towards the use of such filter particles that are less than 1mm.

Furthermore, the Kondo reference provides that filter particles “smaller than 1 mm” would result in an inoperable apparatus that included “growth on the biological membrane or blocking of flow through the filter medium”. It is clearly established patent law that a modification that would result in an inoperable device “teaches away”.

Since the Kondo reference itself teaches that the apparatus cannot operate within the range claimed by the present application, Applicant is not required to provide any further “comparative evidence”. Additionally, Applicant is not required to provide a “showing of unexpected results” when the prior art “teaches away” from the claimed invention.

Contrary to the Examiner’s assertion, Applicant is not required to disclose in his specification how a filter particle size of less than 1 mm would “overcome the problems disclosed in Kondo”. However, in order to expedite prosecution, the Applicant has provided exhaustive details as to how the Kondo reference would not operate with filter particles of less than 1 mm.

Furthermore, with regard to patentability, it is immaterial that the specification of the present invention includes filter particles greater than 1 mm. Applicant submits that the filtration apparatus is capable of being operated using super-buoyant filter particles having a diameter of greater than 1 mm. However, Applicant asserts that his claimed invention is a filtration apparatus capable of being operated using super-buoyant filter particles having a diameter of less than 1 mm. The prior art does not show that a filtration apparatus exists using super-buoyant particles having a diameter of less than 1 mm. Furthermore, the prior art teaches away from using super-buoyant particles having the claimed size.

For the foregoing reasons, Applicant submits that the rejection has been overcome and requests reconsideration and allowance of the claims.

Claim 22 and 23 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. as applied above, and further in view of Iwatani, 4,198,301. For the reasons stated above, Applicant submits that the rejection has been overcome and respectfully requests reconsideration and allowance of the claims.

Claims 32 and 35 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. as above, and further in view of Hsiung, 4,608,181. For the reasons stated above, Applicant submits that the rejection has been overcome and respectfully requests reconsideration and allowance of the claims.

Claim 33 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo in view of Hsiung et al as above, and further in view of Cochrane, 4,211,656 For the reasons stated above, Applicant submits that the rejection has been overcome and respectfully requests reconsideration and allowance of the claims.

Claims 6, 24, and 29-31 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al as above, and further in view of Cochrane, 4,211,656. For the reasons stated above, Applicant submits that the rejection has been overcome and respectfully requests reconsideration and allowance of the claims.

Claim 10 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. as above, and further in view of Daley, 5,178,772. For the reasons stated above, Applicant

submits that the rejection has been overcome and respectfully requests reconsideration and allowance of the claims.

Claim 26 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. as above, and further in view of Muller, 4,383,920. For the reasons stated above, Applicant submits that the rejection has been overcome and respectfully requests reconsideration and allowance of the claims.

Claim 27 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. as above, and further in view of Holland, 6,067,653, and Banks, 4,885,083. For the reasons stated above, Applicant submits that the rejection has been overcome and respectfully requests reconsideration and allowance of the claims.

Claims 1-5, 7-10, 21-25, 27, 28, and 32-36 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-4 of U.S. Patent No. 6,638,422. Applicant is prepared to submit a terminal disclaimer to overcome this rejection upon notification of allowable subject matter. The Examiner is invited to contact the undersigned attorney to expedite the filing of the disclaimer.

Claim 26 stands rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-4 of U.S. Patent No. 6,638,422 in view of Muller, 4,383,920. Applicant is prepared to submit a terminal disclaimer to overcome this rejection upon

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Claims 28 and 34 are objected to as being dependent upon a rejected base claim. For the reasons stated above, Applicant submits that the objection should be withdrawn and respectfully requests reconsideration and allowance of the claims.

Because of the amendments to the claims of the present application, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant respectfully requests reconsideration and allowance of the application.

Respectfully submitted,

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